Attachment 2
Federal Base Network
Station Selection Guidelines

(Revised & ESC Approved: 8 MAY 96)

Monumented points at all NGS-approved continuously operating reference stations (CORS) will be stations of the Federal Base Network (FBN). This document provides the guidelines to be used to select additional FBN stations. These guidelines address the issues of selection priorities, station spacing, monumentation, stability, and accessibility.

Selection Priorities

Station selection shall be based on the following priorities which are given in order with the highest priority first. Within each priority category, preference should be given to selection of older monuments having a known history of previous measurements. Each FBN station should be selected from:

1. Existing A- and B-order station, where possible. At special survey sites such as CORS, WAAS, and VLBI, where several high accuracy monumented stations exist, only one of the monumented stations shall be selected as a FBN. In cases where a protected area exists at the site, the most accessible station shall be selected as the FBN. Other stations at the site shall be designated as CBNs, with the appropriate agency being responsible (FAA, USCG, or State agency).

2. Primary Airport Control Stations (PACS) will be candidates for FBN station selection. Those PACS that are not selected as FBNs will be designated as Cooperative Base Network (CBN) stations, with the responsible agency being FAA. The Secondary Airport Control Stations (SACS) will be designated as User Densification Network (UDN) stations; the responible agency again being FAA. Where necessary, an additional nearby station, which is easily accessible by the public, will be established and directly connected to the airport station.

3. Existing National Geodetic Reference System (NGRS) station with a first- or second-order elevation AND first- or second-order horizontal coordinates, with higher accuracy classification being preferred both vertically and horizontally (giving vertical accuracy top priority).

4. Existing NGRS station with first- or second-order elevation, again the higher accuracy classification being preferred.

5. Existing NGRS station with first- or second-order horizontal coordinates which would require a minimum amount of first- or second-order leveling to establish a precise elevation (within 10 km).

6. New station or existing station not in NGRS suitable for GPS observations, set in bedrock, which would require a minimum amount of first- or second-order leveling to establish a precise elevation (within 10 km).

7. New station or existing station not in NGRS suitable for GPS observations, established by setting a 3D monument, which would require a minimum amount of first- or second-order leveling to establish a precise elevation (within 10 km).

Station Spacing

Unless specified otherwise, the overall FBN shall consist of stations spaced on average approximately 100 km apart. The actual station spacing shall be flexible enough (from 50 km up to 150 km) to allow for optimum station selection. In addition, existing horizontal NGRS stations should be selected in a pattern so that overall, these stations are located in each one-degree block throughout the project. When impossible to meet the above criteria, an additional first- or second-order horizontal NGRS station must be recovered that is suitable for GPS observations. These additional stations shall be selected approximately midway between FBN stations.

Monumentation and Station Environment

- The following are a list of considerations for every monument in the FBN. The intent is to ensure that station monuments will be locally stable and remain usable indefinitely. Each of these considerations is important.
- Adequate GPS satellite visibility (unrestricted at 15 degrees above the horizon). Minor obstructions may be acceptable, but must be depicted on the Visibility Obstruction Diagram.
- Accessible by vehicle (two-wheel drive preferred).
- Stability, bedrock mark being most preferred. (See Stability)
- Permanency.
- Ease of recovery.
- Minimal multi-path sources.
- Appropriate geographic location and spacing.
- Location allows efficient use by surveying community.
- Accessible by public. (See Accessibility)
- No known potential conflict with future development.
- Aerial-photo identifiable.
- Free of electronic interference.

Stability

Mark stability is difficult to assess in the field with limited resources. For existing NGRS station monumentation, the NGS database contains stability qualifiers which were assigned for the majority of marks when they were set. Existing NGRS stations must have a stability quality code of ? C? or better. Quality codes A and B are preferred. New monuments will have a stability quality code of B or better. Quality codes are as follows:

Quality Code A = most reliable which are expected to hold an elevation. Examples: Rock outcrops; rock ledges; rock cuts; bedrock; massive structures with deep foundations; large structures with foundations on bedrock; or sleeved deep settings (10 feet or more) with galvanized steel pipe or galvanized steel, stainless steel, or aluminum rods.

Quality Code B - probably hold an elevation. Examples: Unsleeved deep settings (10 feet or more) with galvanized steel pipe or galvanized steel, stainless steel or aluminum rods; massive structures other than those listed under code A; massive retaining walls; abutments and piers of large bridges or tunnels; unspecified rods or pipe in a sleeve less than 10 feet; or sleeved copper-clad steel rods.

Quality Code C - may hold precise elevation but subject to ground movement. Examples: Metal rods with base plates less than 10 feet deep; concrete posts (3 feet or more deep); unspecified rods or pipe more than 10 feet deep; large boulders; retaining walls for culverts or small bridges; footings or foundation walls of small to medium-size structures; or foundations such as landings, platforms, or steps.

Quality Code D - questionable stability. Examples: Generally, objects of unknown character; shallow set rods or pipe (less than 10 feet); light structures; pavements such as streets, curbs, or aprons; piles and poles such as spikes in utility poles; masses of concrete; or concrete posts less than 3 feet deep.

Quality code C exception -- When selecting FBN stations, only quality codes A and B are recommended. However, concrete posts may be selected with a C stability if the mark is deemed stable from review of historical releveling, soil type, and frost depth. Final selection is subjective, and it is based on local knowledge of soil and frost heave, plus knowledge of how well the mark has held its horizontal and vertical positions over the years.

Accessibility

Accessible public property should be utilized where feasible. If the station is located on private property, permission must be obtained from the land owner for station accessibility. The name of the person or organization granting permission to occupy the station, and a telephone number, must be noted in the station description.